Fisheries and Oceans Canada | Pêches et Océans Canada
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Central and Arctic Region
Canadian Science Advisory Secretariat
Science Advisory Report 2015/017

2015 ASSESSMENT OF NORTHERN SHRIMP, *Pandalus borealis*, AND STRIPED SHRIMP, *Pandalus montagui*, IN THE EASTERN AND WESTERN ASSESSMENT ZONES

*Top: Northern Shrimp (*Pandalus borealis*)*
*Bottom: Striped Shrimp (*Pandalus montagui*)*
Photo: Fisheries Oceans Canada, Newfoundland and Labrador Region.

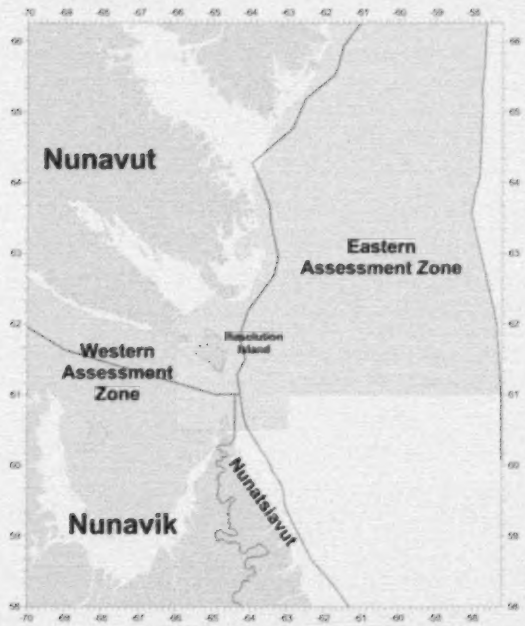

Figure 1. Eastern and Western assessment zones. Boundaries of the Nunavut, Nunavik and Nunatsiavut land claims areas are shown in red.

Context

*Fisheries and Oceans Canada (DFO) Resource Management (RM) has requested Science advice on the status of the two species of shrimp, Northern Shrimp (*Pandalus borealis*) and Striped Shrimp (*Pandalus montagui*) in the waters adjacent to Nunavut. Both species in the Eastern Assessment Zone (EAZ) were last assessed in 2013 (DFO 2013) and updated in 2014 (DFO 2014). For the Western Assessment Zone (WAZ) both species were last assessed in 2010 (DFO 2010) and updated in 2012 (DFO 2012) and 2014 (DFO 2014). Assessments are planned every two years with assessment updates in the intervening years.*

The EAZ and WAZ were adopted in 2011 (DFO 2011) as the basis for setting Total Allowable Catch (TAC) for each species within the management areas adjacent to Nunavut. In the 2013/14 fishing season, a new management system was implemented with three new Shrimp Fishing Areas (SFAs), Nunavut, Nunavik and Davis Strait, established to reflect the three jurisdictions present within this area. These new SFAs were further subdivided into management units which fall entirely within either the EAZ or WAZ.

This assessment follows the framework developed in 2007 for Northern Shrimp off Labrador and the northeastern coast of Newfoundland (DFO 2007a). A series of fishery-independent surveys and fishery data formed the basis of the current assessment.

This Science Advisory Report is from the February 17-23, 2015 Assessment of Northern and Striped Shrimp. Additional publications from this meeting will be posted on the DFO Science Advisory Schedule as they become available.

Canada

SUMMARY

- The assessment includes the survey and fishery data since the 2013 assessment and 2014 update.
- The Central and Arctic Region reorganized its assessment surveys in 2014. For shrimp, the Western Assessment Zone (WAZ) is now to be surveyed annually in conjunction with the Northern Shrimp Research Foundation (NSRF) – DFO/Campelen survey of the Eastern Assessment Zone (EAZ).
- In the WAZ, the 2014 survey begins a new time series, not directly comparable with previous surveys because no trawl standardization between the DFO/Cosmos and NSRF-DFO/Campelen surveys has taken place.
- Survey biomass, fishery data, and fishery exploitation rate indices are used to assess *Pandalus borealis* and *Pandalus montagui*.

Eastern Assessment Zone – *Pandalus borealis*

- Total catch (directed and by-catch) varied without trend around 6,000 t from 1997 through 2014/15. Catch statistics in 2014/15 are not fully available but the Total Allowable Catch (TAC) (8,250 t) will not be taken.
- The fishable biomass index was above the long-term mean during 2009 to 2011 and declined to be below the mean during 2013 and 2014, and in 2014 was at 50,500 t.
- The female spawning stock biomass (SSB) index was above the mean during 2009 to 2012 and declined to be below the mean during 2013 and 2014, and in 2014 was at 34,000 t.
- Recruitment prospects are uncertain.
- The reported exploitation rate index has varied without trend since 2007/08 and in 2014/15 was at the long-term mean of 9.9% with 60% of the TAC taken. Based on the 2014/15 TAC of 8,250 t, the potential exploitation rate index was 16.4%.
- The resource is currently in the Healthy Zone within the Precautionary Approach (PA) framework well above the Upper Stock Reference.

Eastern Assessment Zone – *Pandalus montagui*

- Total catch (directed and by-catch) in 2014/15 was 401 t, 48% of the 840 t TAC.
- Biomass indices have fluctuated widely from 2011 to 2014 making interpretation difficult. The 2014 fishable biomass index was estimated to be 16,600 t. The female SSB index was 12,700 t.
- Recruitment prospects are uncertain.
- The reported exploitation rate index has varied without trend from 2008/09 through 2014/15, averaging 8.3%. The reported exploitation rate index in 2014/15 was 2.4% and the potential exploitation rate index was 5.1%.
- The status of the resource within the PA framework is uncertain because of the wide fluctuations in the female SSB index. As a result, caution is advised when setting the TAC.

Western Assessment Zone – *Pandalus borealis*

- Catch was 847 t in 2014/15 which is about 41% of the 2,080 t TAC.

- In 2014, the fishable biomass index was 21,700 t and female SSB index was 12,300 t.
- The exploitation rate index for 2014/15 was about 4%. The current TAC represents a potential exploitation rate index of about 7%.

Western Assessment Zone – *Pandalus montagui*

- Catch was 5,800 t in 2014/15 of the 5,860 t TAC.
- In 2014, the fishable biomass index was 77,100 t and female SSB index was 38,900 t.
- The exploitation rate index for 2014/15 was about 8%.

BACKGROUND

Species Biology

Northern Shrimp (*Pandalus borealis*) is found in the Northwest Atlantic from Baffin Bay to the Gulf of Maine, and Striped Shrimp (*P. montagui*) is found from Davis Strait south to the Bay of Fundy. Both species have preferred depth and temperature distributions. *P. montagui* prefers cooler water (-1 to 2°C) than *P. borealis* (0 to 4°C). These cooler waters tend to occur in shallower depths. The main density of *P. borealis* tends to occur at 300–500 m while *P. montagui* occur mainly in 200–500 m. Northern Shrimp are associated with soft substrates whereas Striped Shrimp prefer harder bottoms.

Both species of shrimp are protandric hermaphrodites, functioning as males early in their lives then changing sex and reproducing as females for the remainder of their lives. Females usually produce eggs once a year in the late summer-fall and carry them, attached to their abdomen, through the winter until the spring, when they hatch. Newly hatched shrimp spend three to four months as pelagic larvae. At the end of this period they move to the bottom and take up the life style of the adults. Both species migrate into the water column during the night. The migration consists mainly of males and smaller females. Shrimp are opportunistic feeders on or near the sea floor and in the water column. Shrimp ageing is uncertain but shrimp in the north are thought to live five to eight years. Growth rates and maturation are likely slower in northern populations. *Pandalus* shrimp are important forage species.

Fishery

The fishery is managed by Total Allowable Catch (TAC) which is divided into quotas for the 17 offshore license holders and special allocations for Nunavut and Nunavik interests. Changes to the management of the fishery in what was Shrimp Fishing Area (SFA) 2 and 3 created new SFAs and Management Units beginning with the 2013/14 fishing season (Figure 2). The 17 offshore license holders have access to SFA Davis Strait. Their quota is further subdivided by enterprise allocation with each receiving a 1/17 share per license. Nunavut and Nunavik each have quotas that can be fished anywhere within either of their two land claims areas. Nunavut also has quota that can be fished within management unit Davis Strait-East. Nunavut Wildlife Management Board (NWMB) and Nunavik Marine Region Wildlife Board (NMRWB) control the sub-allocation of their quotas. All fishing to date has been conducted by large vessels with 100% observer coverage.

Fishing gear consists of single and, more recently, twin shrimp trawls requiring a minimum codend mesh size of 40 mm and Nordmøre separator grate (maximum 28 mm bar spacing). Since 2003, the management year has been 1 April to 31 March. The fishing season is limited by the extent of sea ice, and is conducted between May and December in most years.

P. borealis has been the main commercial species throughout the history of the shrimp fishery in this area. Historically most of the harvest of *P. montagui* occurred as by-catch in the directed *P. borealis* fishery. Directed fishing for *P. montagui* has become more important especially with new quotas available in SFA Nunavut-West and Nunavik-West beginning with the 2013/14 fishing season.

The fishery began in the late 1970s in SFA 1. Exploratory fishing expanded into what is now SFA Davis Strait-East (previously SFA 2) and then to areas southeast of Resolution Island in Hudson Strait. Quotas in these areas were based on fishery performance and not scientific survey data. In the mid-1990s, the fishery moved southeast of Resolution Island in SFA 2, where the main fishery remains to date. Implementation of the Nunavut Land Claims Agreement in 1999 shifted the main fishery east of the Nunavut Settlement Area. Over the last ten years, the distribution of fishing effort has remained unchanged.

Fishery CPUE is not considered to reflect stock status. Commercial fishing locations are not broadly distributed; captains select areas of high density. A mix of two shrimp species is targeted in the fishery and the composition of the two species in the catch determines which species is designated as directed which biases CPUE calculations. Over the time period of the fishery, economic factors (e.g., fuel prices, price of shrimp) have influenced when and where the species are caught. In the EAZ, captains have learned over the years to target each species to achieve cleaner catches of just one species. Renewed effort in the WAZ is recent, with captains only having a few trips in the area. Whether cleaner catches can be similarly achieved in the WAZ remains to be seen.

ASSESSMENT

This is an assessment of both *P. borealis* and *P. montagui* in the EAZ and WAZ (Figure 1) (Siferd 2015). These two species have overlapping distributions, especially in the Resolution Island area, resulting in an overlap of their fisheries. The total removal, both directed catch and by-catch, of each species is considered in the assessment.

New survey data considered in this assessment comes from the 2013 and 2014 Northern Shrimp Research Foundation (NSRF)–DFO surveys of the EAZ (Resolution Island Study Area (RISA)-W, RISA-E and SFA 2EX survey areas, Figure 2). Survey data are available for the period of 2006–2014 however the first two years in the EAZ are not considered comparable with the rest of the series because of incomplete coverage and operational issues so only 2008–2014 data are evaluated.

The WAZ had been surveyed biennially by DFO from 2007-2013. Because the WAZ had been surveyed by a different ship, gear and time of year, it could not be combined with the survey results of the EAZ. This prevented a comprehensive evaluation of the distributions of shrimp and a more practical look at broader stock implications. In 2014, the NSRF was commissioned to take over the survey of the WAZ so that is sampled in conjunction with the EAZ sampling thus eliminating barriers indicated above. This action starts a new time series for the WAZ. It will require about four additional years to develop a data series to assess the status of the whole population.

The assessment follows the framework established by DFO (2007a). Fishable and female spawning stock biomass (SSB) indices from scientific surveys form the basis of the assessment. Fishable biomass is based on male and female shrimp from the surveys with a carapace length greater than 17 mm. SSB is based on all female shrimp from the surveys regardless of size. The recruitment index is based on the abundance of shrimp from 11.5 to 17 mm carapace length. An acceptable method to calculate total instantaneous mortality (Z) has not been found and therefore was not included as part of the assessment. Fishery data are used to determine observed exploitation rate index as catch from observer records divided by the fishable biomass index from

the same year. The potential exploitation rate index was calculated assuming the entire TAC was taken. Bootstrapped 95% confidence intervals are included for each of the indices.

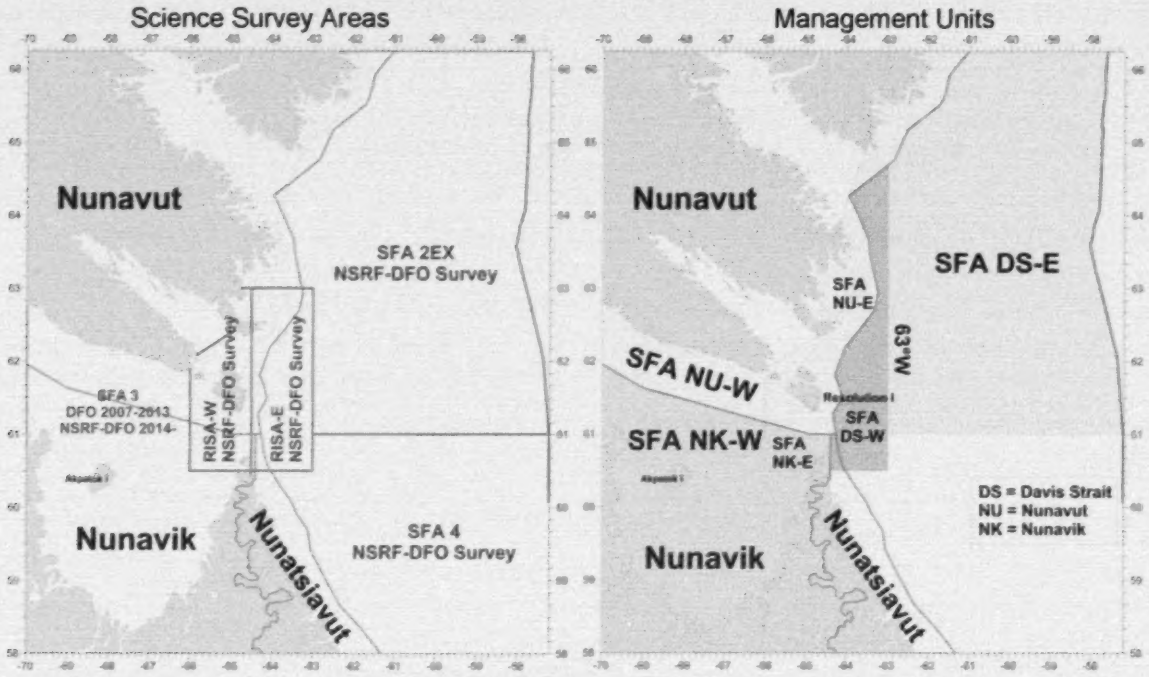

Figure 2. Location of the northern survey areas (left panel) within the Eastern and Western Assessment Zones (Figure 1) and the management units (right panel) referred to in this report. Shrimp Fishing Area (SFA), Exploratory (EX), Resolution Island Study Area (RISA), East (E), West (W), Nunavut (NU), Nunavik (NK) and Davis Strait (DS). Red line shows the borders of the Nunavut, Nunatsiavut and Nunavik Land Claims Areas.

For this assessment, resource status in the EAZ was evaluated within the Precautionary Approach (PA) framework (DFO 2006). There are reference points (RP) (DFO 2009) and an Integrated Fisheries Management Plan (IFMP) (DFO 2007b) for shrimp in the EAZ. The Limit Reference Point (LRP) is 30% and the Upper Stock Reference (USR) is 80% of the geometric mean of SSB for 2006-2008. RPs for the WAZ were developed with the same proxies and adopted at the 2012 ZAP (DFO 2012) but are no longer applicable because 2014 is the start of a new survey time series.

The WAZ was surveyed biennially with the Greenland Institute of Natural Resources' research vessel *Paamiut* using a Cosmos trawl from 2007-2013. The EAZ was surveyed with the commercial fishing vessels *Cape Ballard* from 2005 to 2011, and *Aqviq* in 2012 and 2013. Both the EAZ and WAZ were surveyed by the commercial fishing vessel *Kinguk* in 2014. A standard Campelen trawl was used to sample the EAZ in 2006 and 2007. In 2008, to improve coverage and reduce the incidence of tear-ups in the RISA survey area, a modified Campelen trawl was developed (Siferd and Legge 2014) and first used. That same year, a standard Campelen trawl was used in the SFA 2EX survey area. The modified Campelen trawl has been used on all NSRF-DFO/Campelen surveys in the EAZ (since 2008) and WAZ (in 2014). There has been no standardization between the DFO/Cosmos and the NSRF-DFO/Campelen surveys.

An added complication when interpreting the trawl survey data is the strong tidal currents in Hudson Strait, up to five knots, which could result in quick shifts in shrimp distribution and catchability.

Eastern Assessment Zone – *P. borealis*

Fishery

Catch has varied without trend around 6,000 t from 1997 through 20014/15 (Figure 3). The total reported catch (directed and by-catch) for 2014/15 as of 22 January 2015 Canadian Atlantic Quota Report (CAQR) was 4,972 t, 60% of the TAC (8,250 t). The 2014/15 fishery runs until 31 March 2015 but ice conditions in January have curtailed fishing in the zone. The majority of catch taken in the EAZ comes from SFA DS-W (Figure 2) southeast of Resolution Island and east of the Nunavut and Nunavik Land Claims borders.

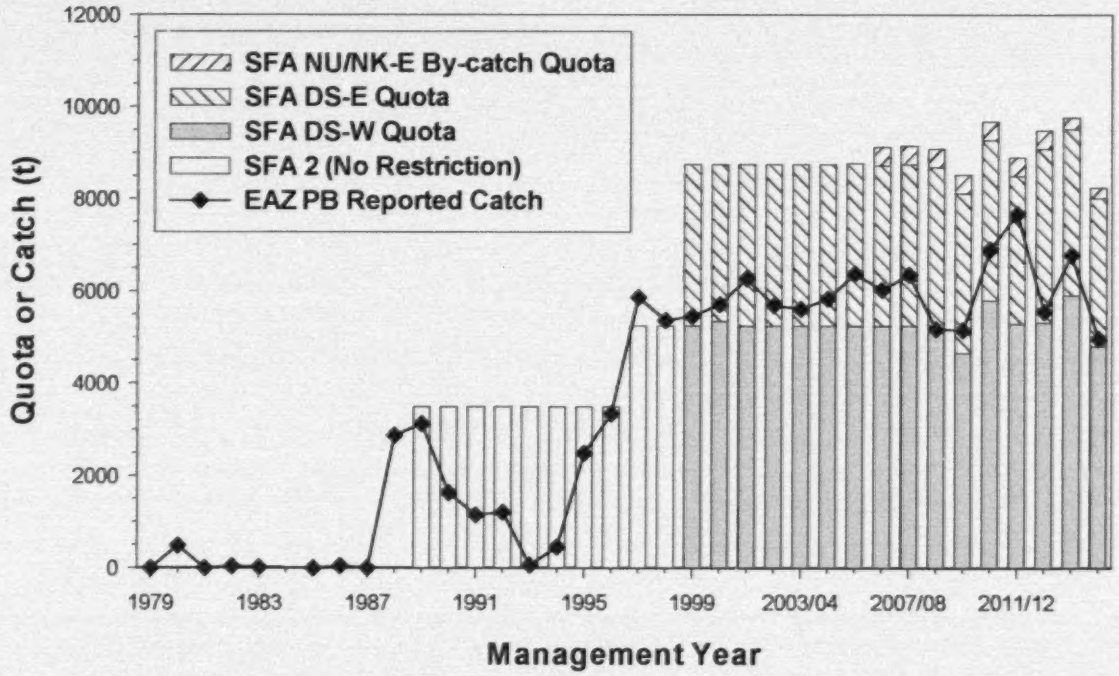

Figure 3. Eastern Assessment Zone Pandalus borealis *TAC and catch reported in the Canadian Atlantic Quota Report. The 2014/15 data are as of 22 January 2015.*

Biomass

The fishable biomass index was above the long-term mean during 2009 to 2011 and declined to be below the mean during 2013 and 2014, and in 2014 was 50,500 t (Figure 4a). The female SSB index was above the mean during 2009 to 2012 and declined to be below the mean during 2013 and 2014, and in 2014 was 34,000 t (Figure 4b).

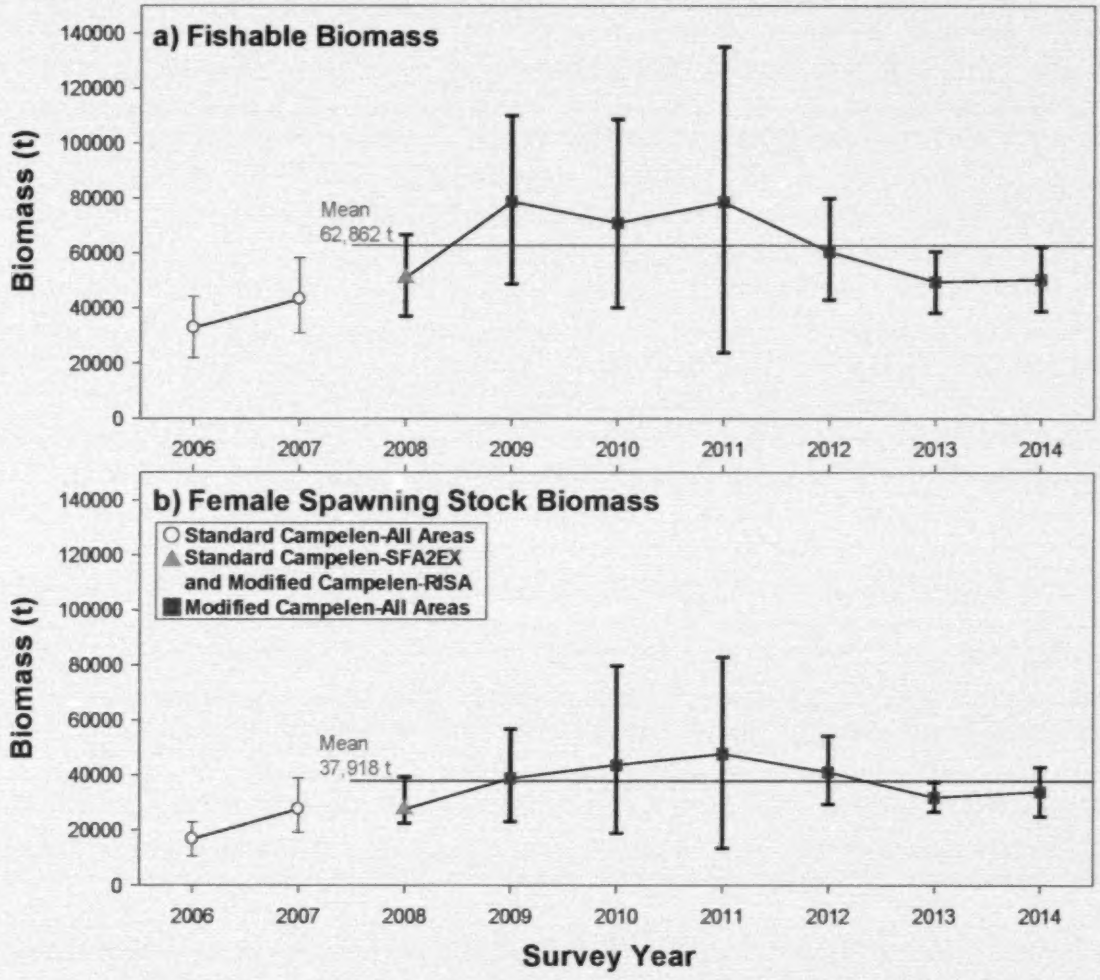

Figure 4. The Eastern Assessment Zone fishable and female spawning stock biomass indices of Pandalus borealis *for the survey years 2006–2014. The first two years of survey data (2006–2007) are not considered to be comparable with the rest of the series because of poor trawl performance around Resolution Island. Error bars are 95% confidence ranges.*

Recruitment

Recruitment prospects are uncertain. Too few recruitment-sized shrimp are caught in the codend during the survey to produce a meaningful index.

Exploitation

The reported exploitation rate index has varied without trend since 2007/08 and in 2014/15 was at the long-term mean of 9.9% with 60% of the TAC taken (Figure 5a). Based on the 2014/15 TAC of 8,250 t, the potential exploitation rate would be 16.4% (Figure 5b) with about a 6% chance of being above the maximum removal reference[1].

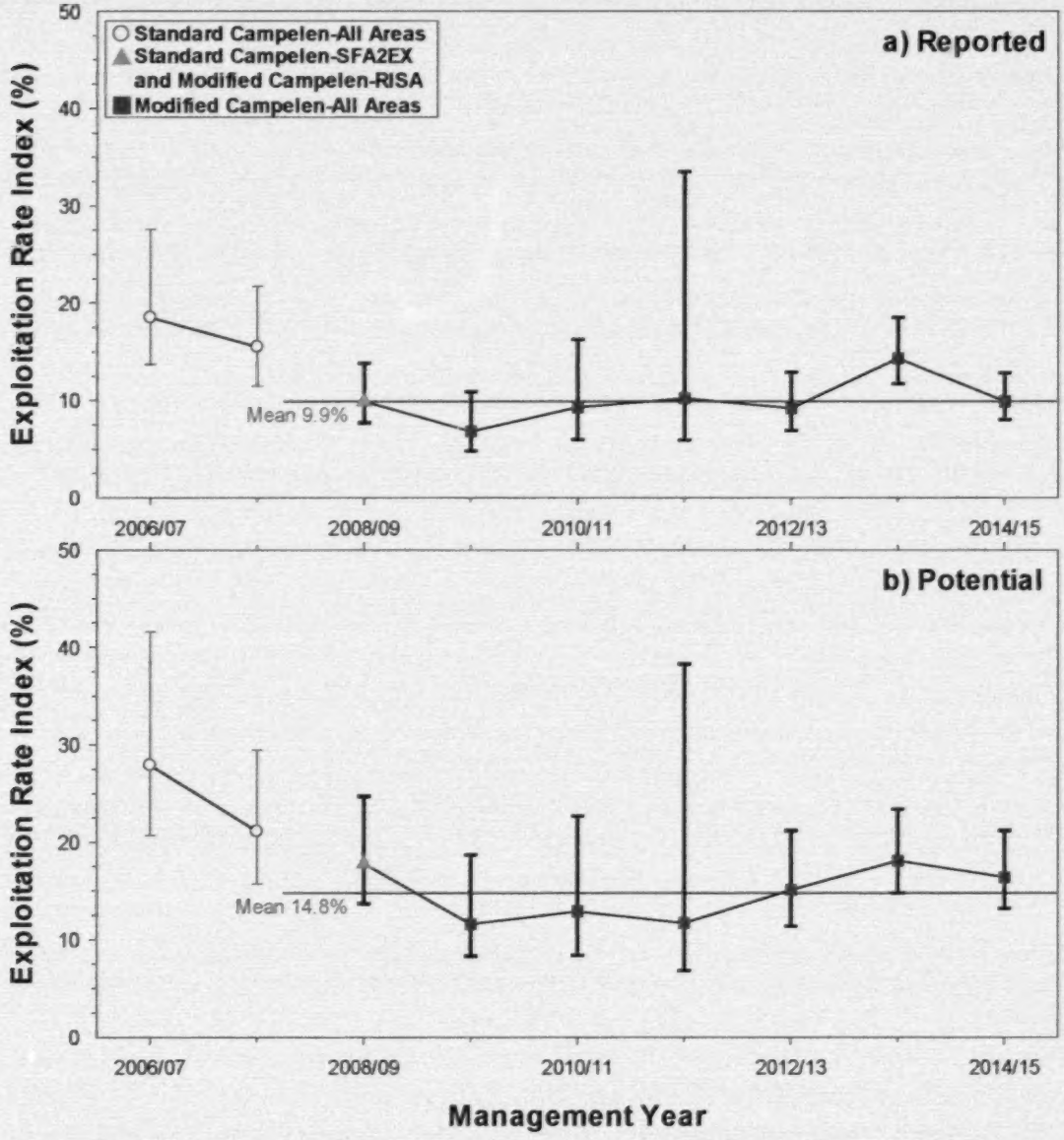

Figure 5. The Eastern Assessment Zone Pandalus borealis *exploitation rate indices for a) the reported rate based on the catch taken and b) the potential rate if the TAC assigned to the zone was taken. The first two years of survey data (2006–2007) are not considered to be comparable with the rest of series because of poor trawl performance around Resolution Island. Error bars are 95% confidence ranges.*

[1] 20% ER is the maximum removal reference point in the Healthy Zone accepted by the Precautionary Approach (PA) Working Group but not yet adopted by the Northern Shrimp Advisory Committee or implemented by Fisheries Management.

Current Outlook

The 2014/15 female SSB is currently well within the Healthy Zone of the PA Framework (Figure 6). There is very little chance of transgressing either the Upper Stock Reference or the maximum exploitation rate of 20%.

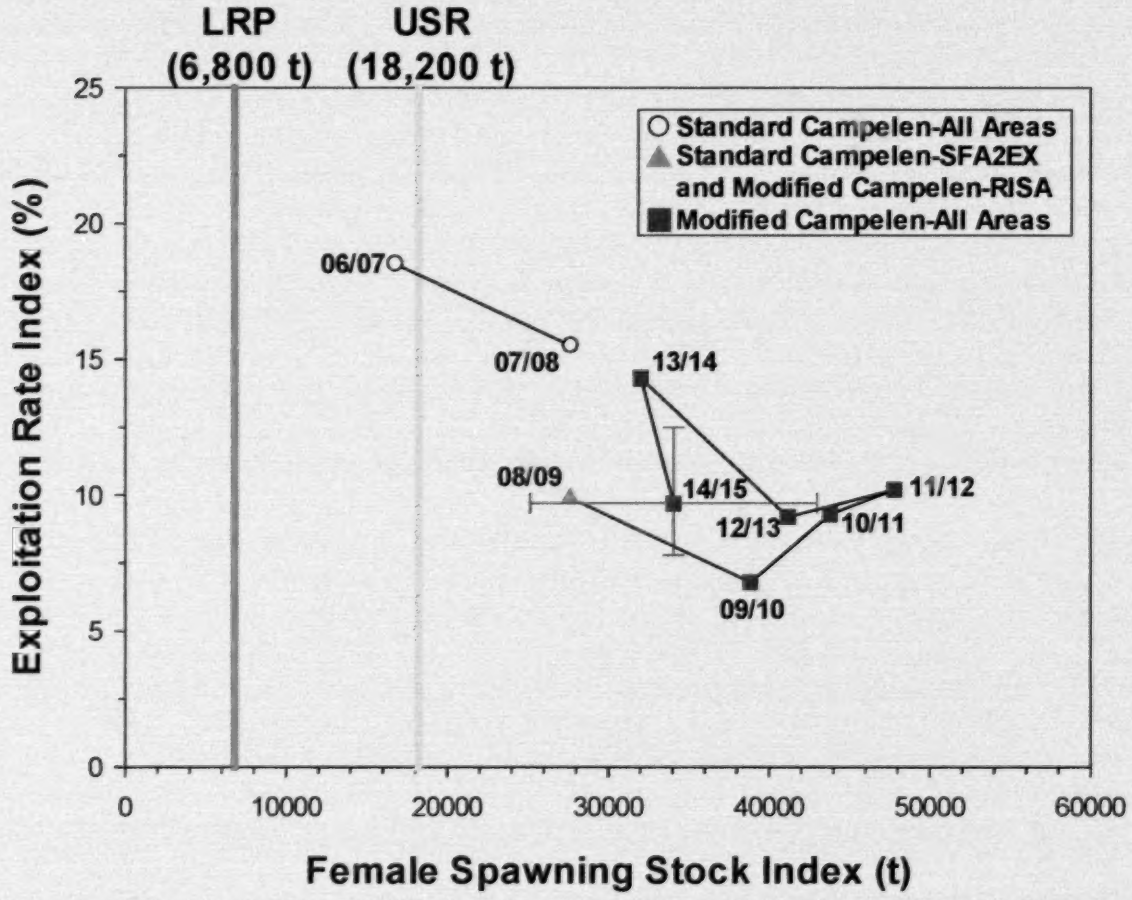

Figure 6. The Eastern Assessment Zone trajectory of Pandalus borealis *female spawning stock biomass and exploitation rate indices in relation to its reference points. USR=Upper stock reference and LRP=limit reference point are 80% and 30% respectively of the geometric mean of the SSB index (2006–2008 in SFA 2). Error bars are 95% confidence ranges.*

Eastern Assessment Zone – *P. montagui*

Fishery

Quotas were adjusted and implemented in the new management units beginning in 2013/14 fishing season. The catch (directed and by-catch) under the new system was 950 t in 2013/14 and in 2014/15, was 401 t (as of the 22 January 2015 CAQR) representing 48% of the 840 t TAC (Figure 7). The 2014/15 fishery runs until 31 March 2015 but ice conditions in January have curtailed fishing in the zone.

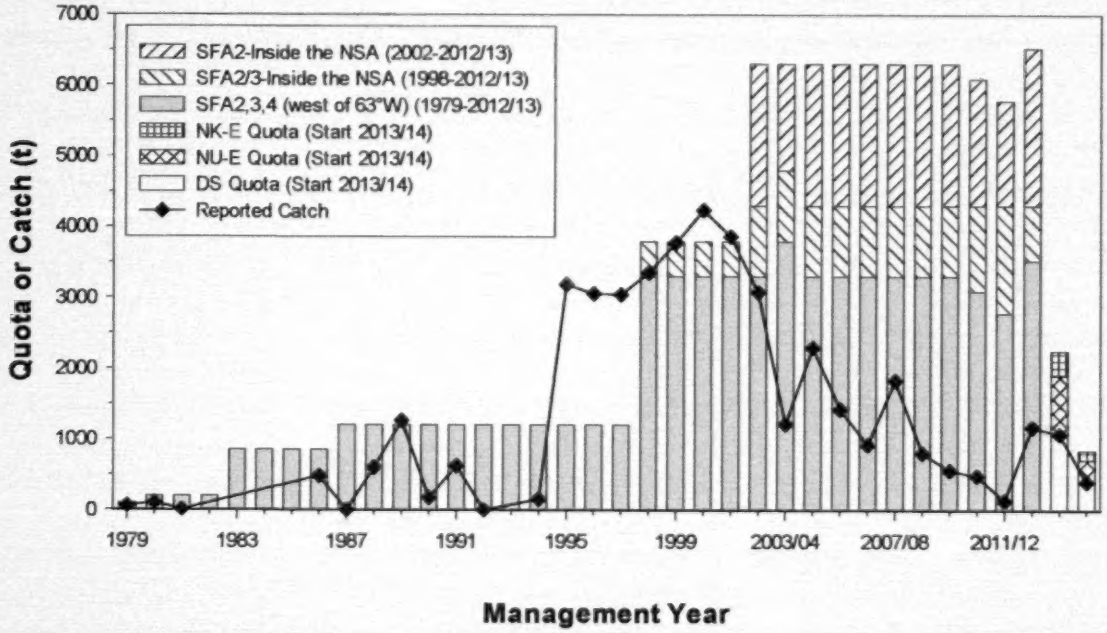

Figure 7. Eastern Assessment Zone Pandalus montagui *TAC and catch reported in the Canadian Atlantic Quota Report (CAQR). The 2014/15 data are from CAQR as of 22 January 2015.*

Biomass

Biomass indices have fluctuated widely from 2011 to 2014 making interpretation of stock status difficult. The 2014 fishable biomass index was estimated to be 16,600 t, a significant increase from 2013 (Figure 8a). The female SSB index showed a similar increase and was estimated to be 12,700 t in 2014 (Figure 8b). The large increase in both biomass indices in 2014 repeats the sharp increase observed between 2011 and 2012. The fluctuations in biomass indices likely result from transfer across management boundaries rather than local dynamics within a population.

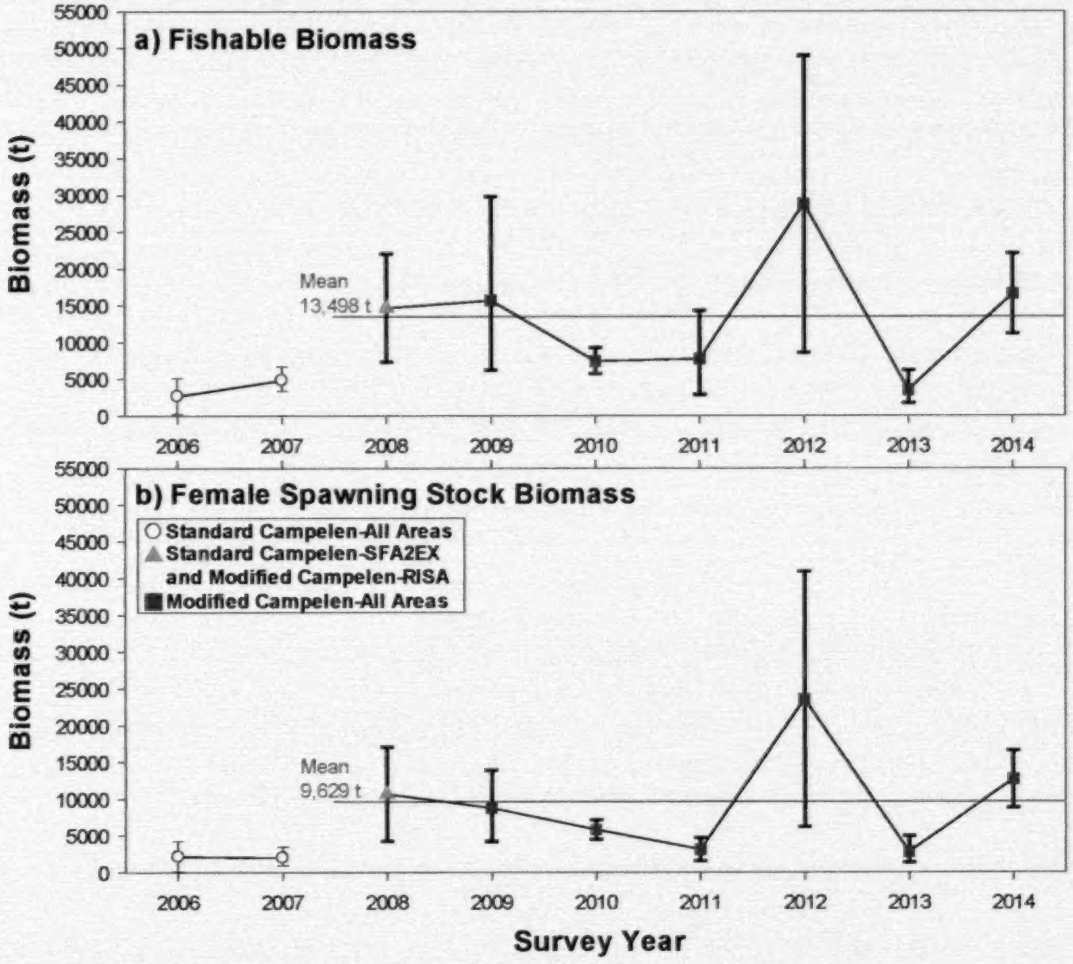

Figure 8. The Eastern Assessment Zone Pandalus montagui *fishable and female spawning stock biomass indices for the survey years 2006–2014. Error bars are 95% confidence ranges.*

Recruitment

Recruitment prospects are uncertain. Too few recruitment-sized shrimp are caught in the codend during the survey to produce a meaningful index.

Exploitation

The reported exploitation rate index had varied without trend from 2008/09 through 2014/15 averaging 8.3% (Figure 9a). The increase in biomass combined with a reduced catch in 2014/15 from the previous season resulted in a large decrease in the exploitation rate index to 2.4% for 2014/15 (Figure 9a). The potential exploitation rate index has a long-term mean of 47.3% but the 2014/15 estimate was well below the mean at 5.1%.

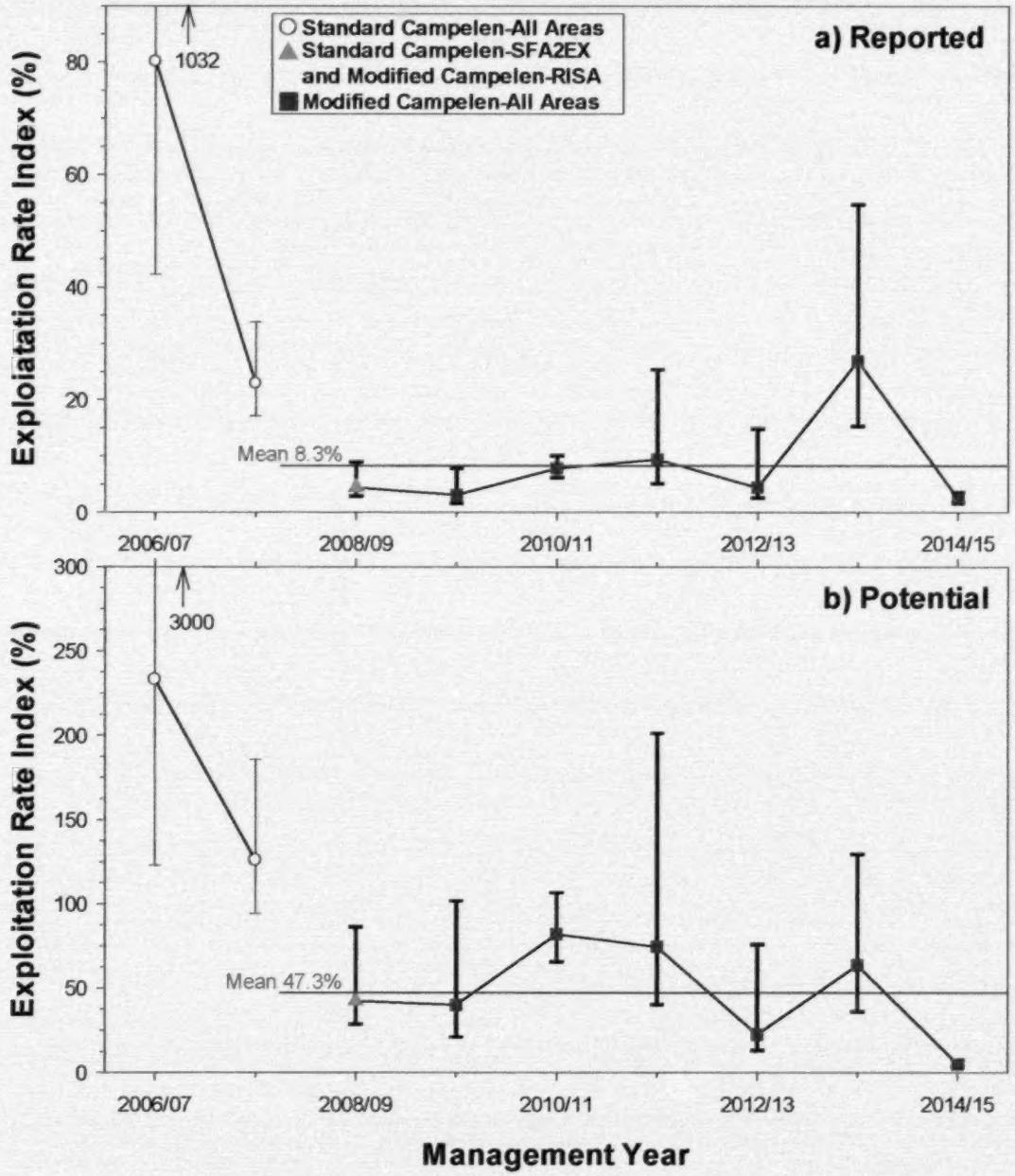

Figure 9. The Eastern Assessment Zone Pandalus montagui *exploitation rate indices for a) the reported rate, based on the catch taken and b) the potential rate if the TAC was taken. Error bars are 95% confidence ranges. Upper confidence limit for 2006/07 is shown numerically.*

Current Outlook

The status of the resource within the PA framework is uncertain because of the wide fluctuations in the female SSB index (Figure 10). As a result, caution is advised when setting the TAC.

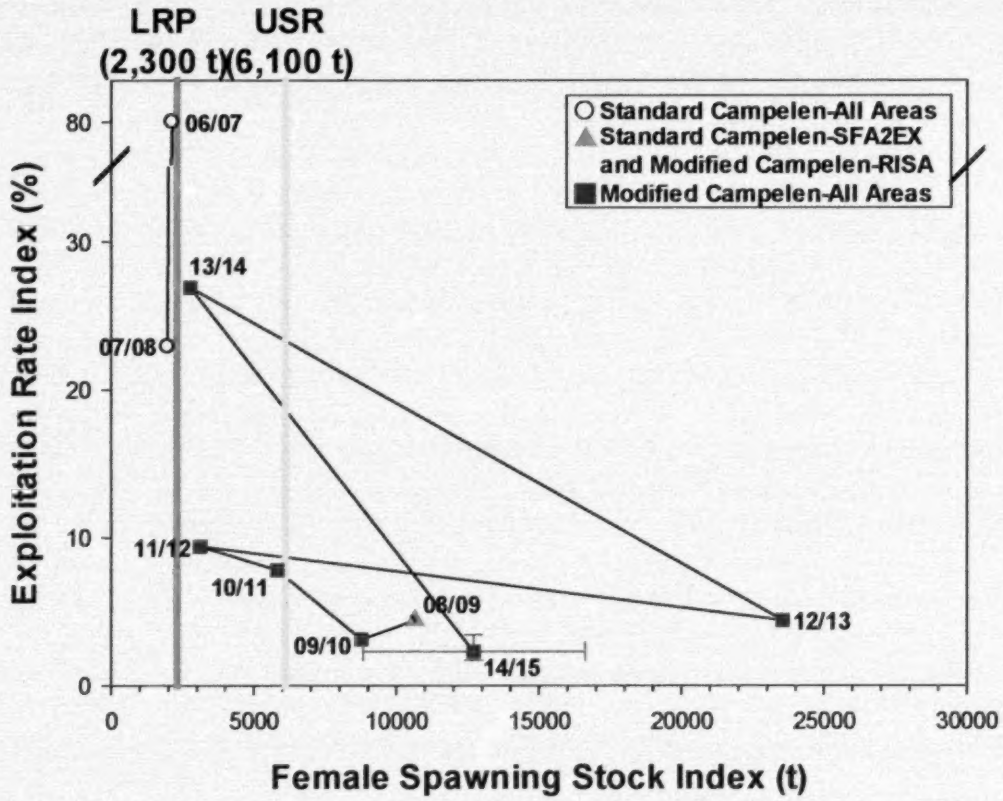

Figure 10. The Eastern Assessment Zone trajectory of Pandalus montagui *female spawning stock biomass and exploitation rate indices in relation to its reference points. USR=Upper stock reference and LRP=limit reference point are 80% and 30% respectively of the geometric mean of the SSB index (2006-2008 in SFA 2). Error bars are 95% confidence ranges.*

Western Assessment Zone – *P. borealis*

Fishery

With the implementation of new management areas in the north, quotas for directed fishing were established for the first time for the 2013/14 fishing year at 1,500 t (Figure 11). The TAC was increased to 2,080 t for 2014/15. Catch records from CAQR as of 22 January 2015 show that about 847 t or 41% of the TAC had been caught. The 2014/15 fishery runs until 31 March 2015 but ice conditions in January have curtailed fishing in the zone.

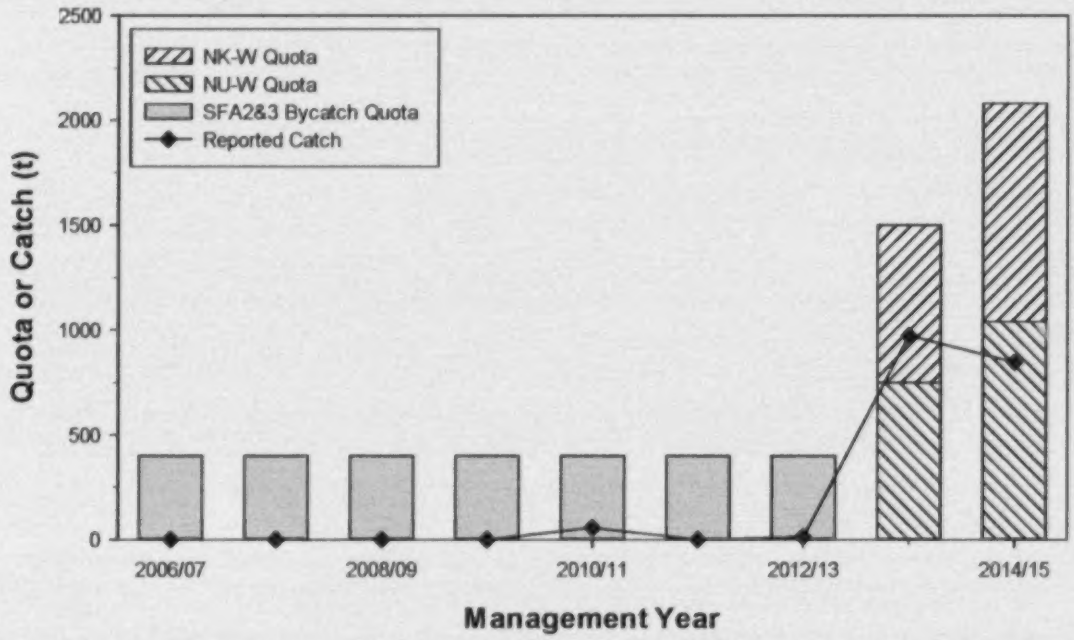

Figure 11. The Western Assessment Zone Pandalus borealis *TAC and catch recorded in the Canadian Atlantic Quota Report (CAQR) for 2014/15 and observer records prior to 2013/14. Catch records from CAQR as of 22 January 2015.*

Biomass

The 2014 survey begins a new time series, not directly comparable with previous surveys because no trawl standardization between the DFO/Cosmos and NSRF-DFO/Campelen surveys has taken place. In 2014, the fishable biomass index was 21,700 t and the female SSB index was 12,300 t (Figure 12).

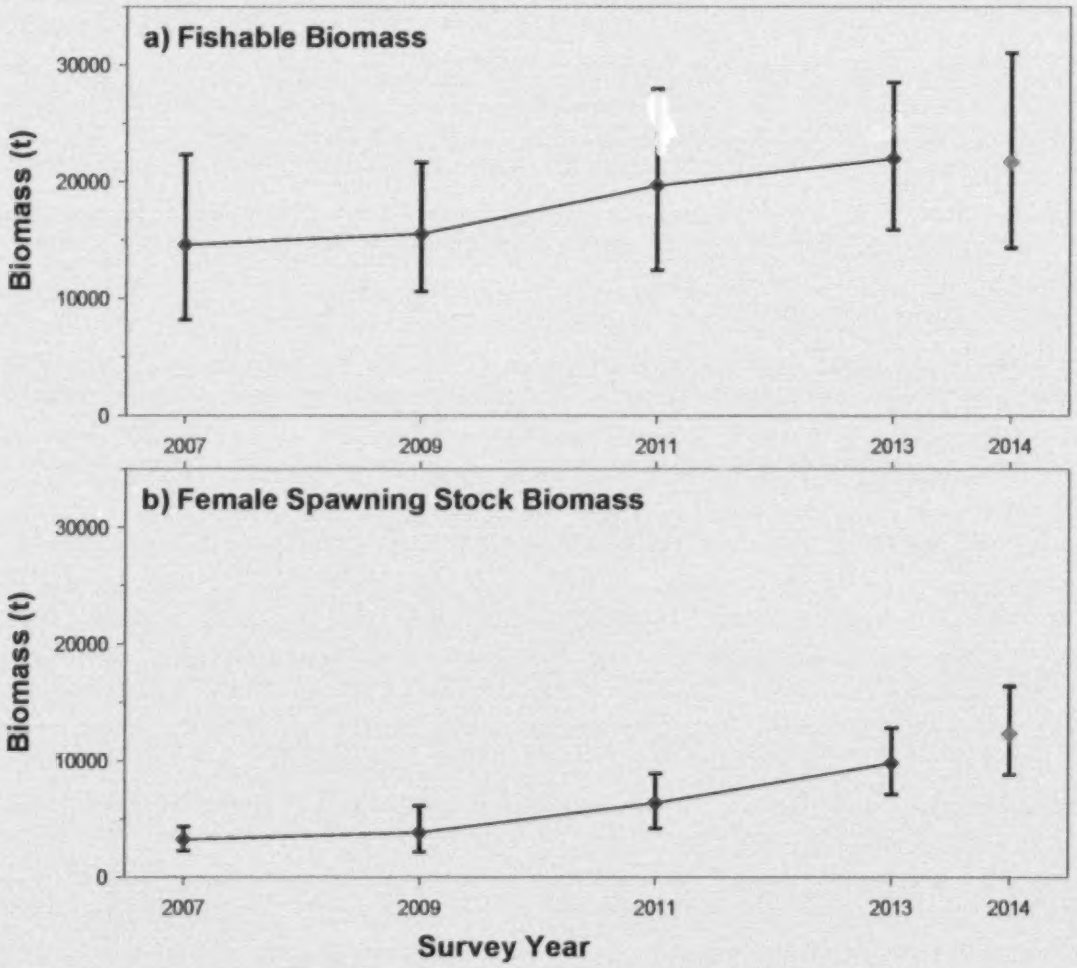

Figure 12. Western Assessment Zone Pandalus borealis, *a) fishable biomass and b) female spawning stock biomass indices for the four years of DFO/Cosmos surveys. The 2014 survey (red diamond) was conducted by the NSRF-DFO/Campelen and represents the start of a new time series for the WAZ. Error bars are 95% confidence ranges.*

Exploitation

Exploitation rate indices are not directly comparable to those of previous survey years. The exploitation rate index for 2014/15 was about 4%. The current TAC represents a potential exploitation rate of about 7% (Figure 13).

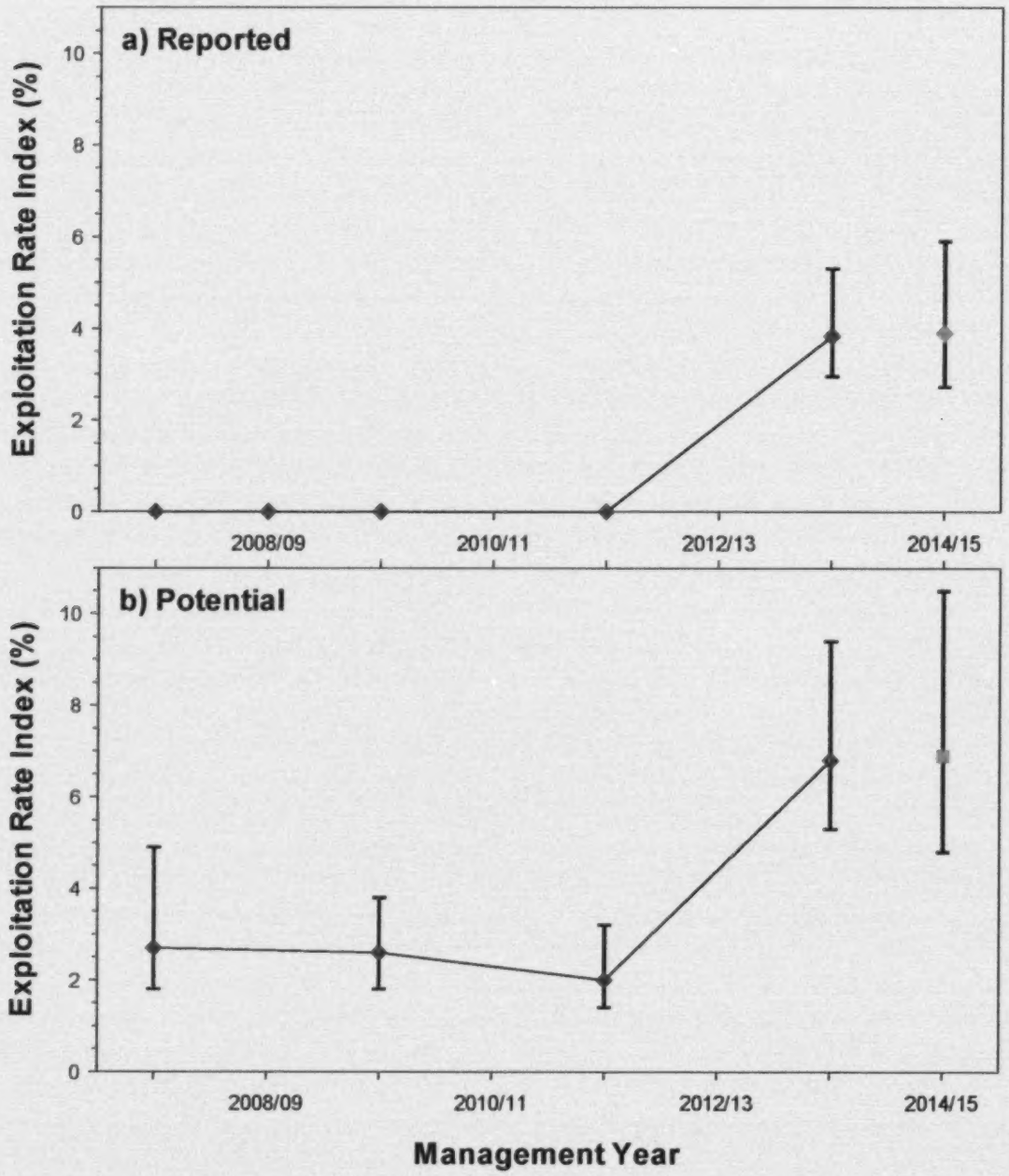

Figure 13. Pandalus borealis *Western Assessment Zone exploitation rate indices for the a) reported rate, based on the Canadian Atlantic Quota Report catch and the b) potential rate if the entire TAC assigned to the zone was taken. Error bars are 95% confidence ranges.*

Current Outlook

The current outlook is unknown. The 2014 results represent the start of the new Campelen trawl survey and cannot be evaluated in relation to the current PA framework. A new PA framework will require about four additional years to develop a data series to assess the status of the whole population. In 2015/16, the potential exploitation rate index will be about 7% assuming the TAC and biomass remain unchanged.

Western Assessment Zone – *P. montagui*

Fishery

With the implementation of new management areas in the north, quotas for directed fishing were established for the first time for the 2013/14 fishing year at 5,000 t (Figure 14). The TAC was increased to 5,860 t for 2014/15. Catch records from CAQR as of 22 January 2015 show that the TAC was taken.

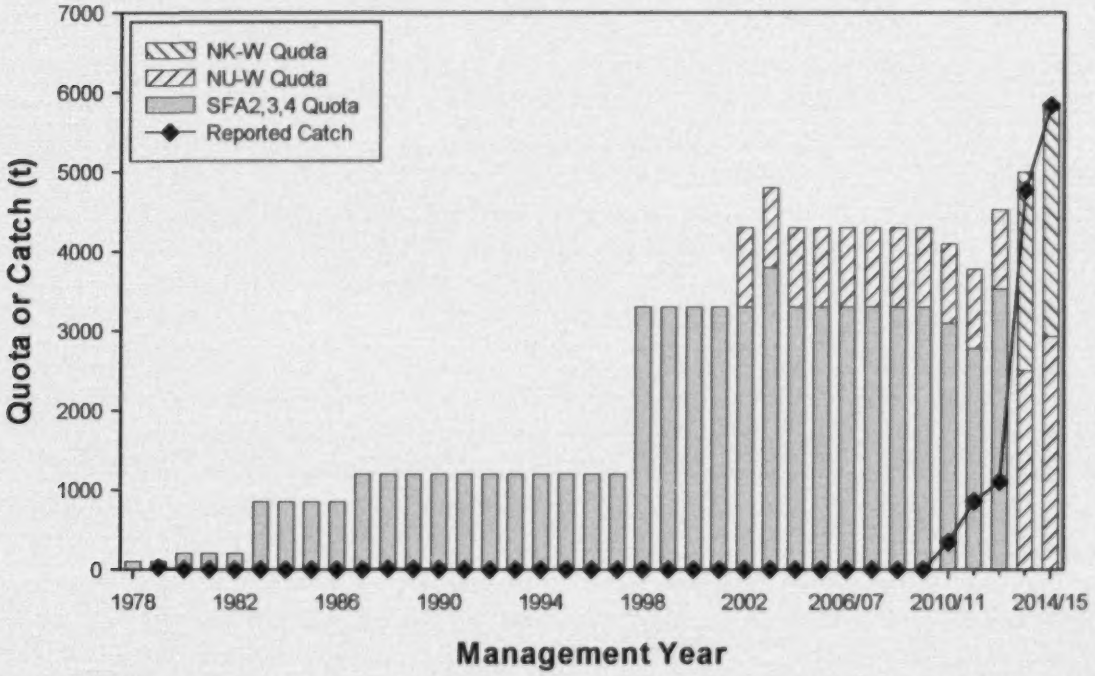

Figure 14. The Western Assessment Zone Pandalus montagui *TAC and catch recorded in the Canadian Atlantic Quota Report (CAQR). Catch based on CAQR as of 22 January 2015.*

Biomass

The 2014 survey begins a new time series, not directly comparable with previous surveys because no trawl standardization between the DFO/Cosmos and NSRF/Campelen surveys has taken place. In 2014, the fishable biomass index was 77,100 t and female SSB index was 38,900 t (Figure 15).

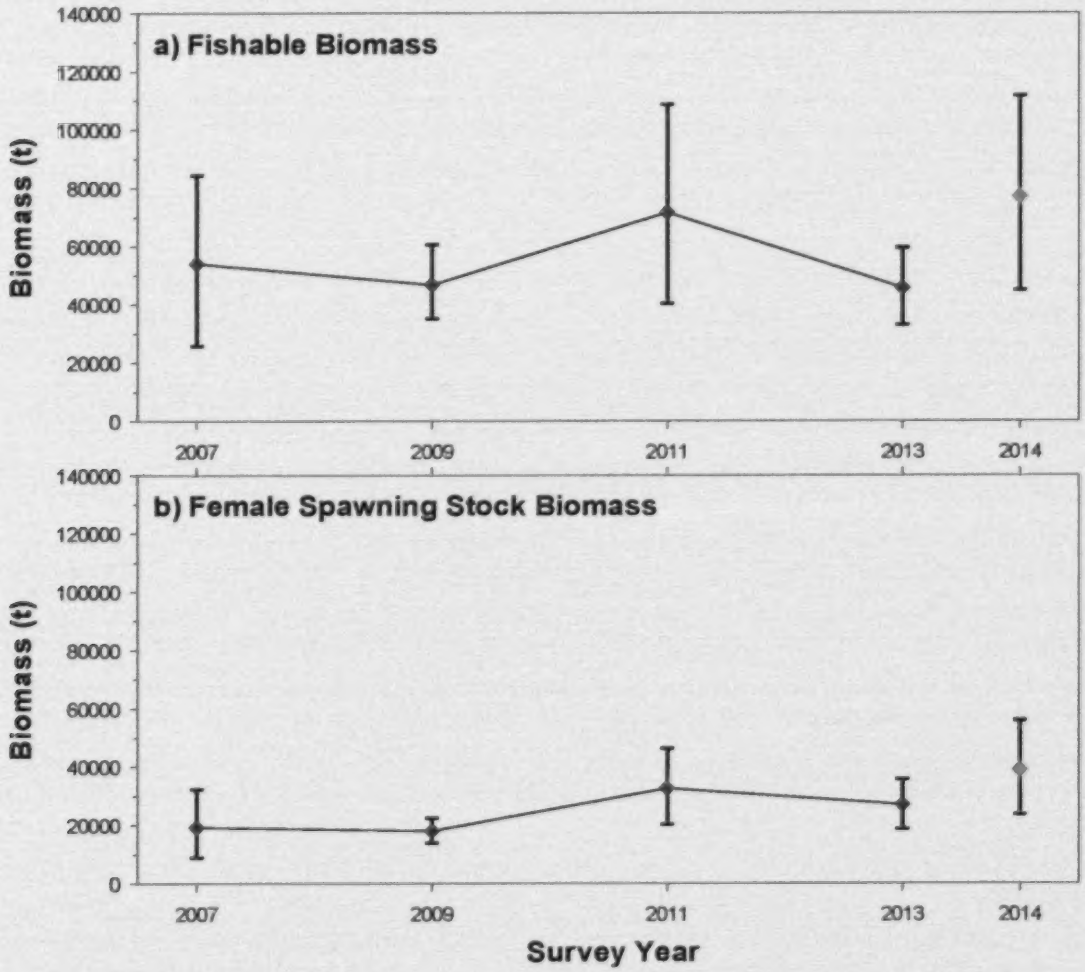

Figure 15. Western Assessment Zone Pandalus montagui, *a) fishable biomass and b) female spawning stock biomass indices. Included are four years of DFO/Cosmos surveys (blue diamonds), and the 2014 NSRF-DFO/Campelen survey (red diamond) which represents the start of a new time series. Error bars are 95% confidence ranges.*

Exploitation

Exploitation rate indices are not directly comparable to those of previous survey years. The TAC was taken in 2014/15 resulting in an exploitation rate index of about 8% (Figure 16).

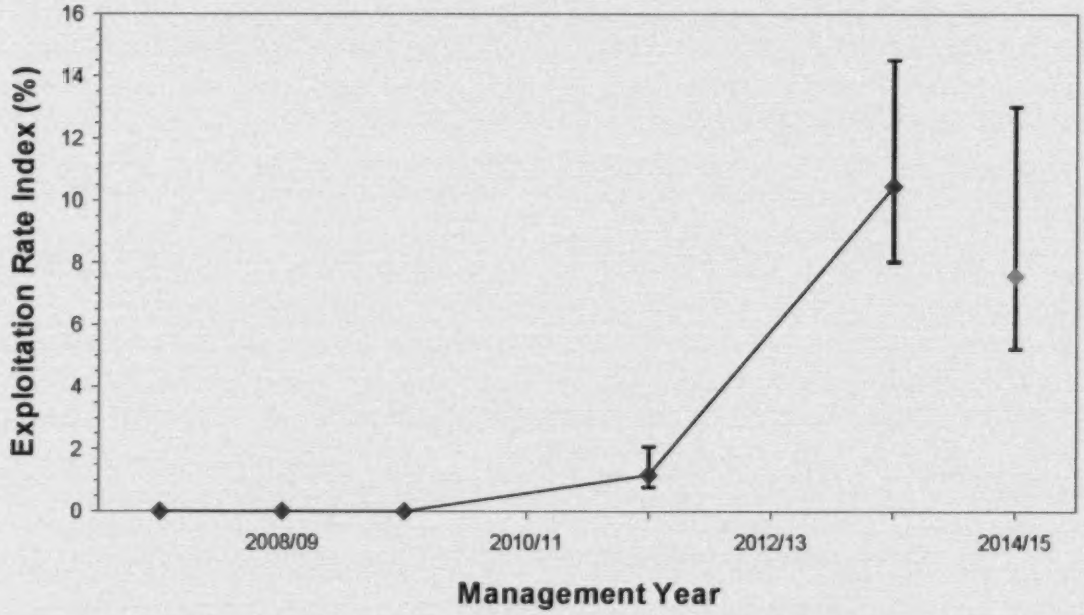

Figure 16. The reported Western Assessment Zone Pandalus montagui *exploitation rate index. The DFO/Cosmos survey (blue diamonds) is not directly comparable with the 2014 survey (red diamond) conducted by the NSRF-DFO/Campelen. 2014 represents the start of a new time series. Error bars represent 95% confidence range.*

Current Outlook

The current outlook is unknown. The 2014 results represent the start of the new Campelen trawl survey and cannot be evaluated in relation to the current PA framework. A new PA framework will require about four additional years to develop a data series to assess the status of the whole population. In 2015/16, the exploitation rate index will be about 8% assuming the TAC and biomass remain unchanged.

Sources of Uncertainty

Hudson Strait is a highly dynamic system with strong tidal currents and mixing. Shrimp could be transported great distances in a relatively short period of time in and out of the WAZ, EAZ, and SFA 4 to the south. This is the most likely cause in the wide fluctuations in biomass seen in these areas. Assessing only a subset of a larger population is a source of uncertainty in determining the true status of a resource.

Experimental work done by DFO in 2007 in the Resolution Island area suggests that survey results may be affected by the tidal cycle. Surveys from 2006 – 2008 were all conducted at the height of the spring tide, while the 2009 – 2014 surveys were conducted at neap tides to minimize the tidal effect. Regardless, the survey is conducted over a 24-hour period so strong tidal currents would still be present and may result in either an over- or underestimate of biomass.

The survey in the WAZ represents a new data series beginning in 2014 and is now an annual survey. The WAZ is now being surveyed with the same ship and trawl, conducted at the same time

of year as the survey of the EAZ thus removing issues identified previously about comparing populations in the two assessment zones.

Trawls used in the survey are known to have a catchability less than one but the exact value is unknown. Therefore, the survey is an index of biomass and not an estimate of the total biomass. Catch is known; however, the total fishery-induced mortality is unknown (landed catch plus incidental mortality from trawling). Exploitation rates are a relative index rather than absolute.

The validity of the PA stock reference points used in this assessment is questionable in the EAZ. Estimates from three surveys were used to calculate the reference points and it is uncertain how the biomass during this period relates to B_{MSY}. In addition, the reference points no longer correspond to the assessment area and the first two surveys are no longer considered comparable with the remainder of the time series.

Three research vessels have been used throughout the time series in the EAZ. Expert opinion was that, given the commonality of the ships' dimensions, relative catchability would be consistent among vessels. However, this was not tested.

CONCLUSIONS AND ADVICE

Eastern Assessment Zone – *P. borealis*

The current status of this resource is considered healthy within the PA framework. Based on the 2014/15 TAC of 8,250 t the potential exploitation rate index was 16.4%.

Eastern Assessment Zone – *P. montagui*

The status of the resource is uncertain because of the wide fluctuations in female SSB index over the past four years. Therefore, caution is advised when setting the TAC.

Western Assessment Zone – *P. borealis*

The current status of this resource is unknown, given that the PA framework reference points were based on surveys no longer comparable to the new time series begun in 2014. Maintaining current TAC levels would be cautious until the time series is sufficiently long to develop new reference points. Based on the 2014/15 TAC of 2,080 t the potential exploitation rate index was about 7%.

Western Assessment Zone – *P. montagui*

The current status of this resource is unknown, given that the PA framework reference points were based on surveys no longer comparable to the new time series begun in 2014. Maintaining current TAC levels would be cautious until the time series is sufficiently long to develop new reference points. Based on the 2014/15 TAC of 5,860 t the potential exploitation rate index was about 8%.

MANAGEMENT CONSIDERATIONS

In general, management of key forage species such as shrimp, under an ecosystem approach, requires adoption of a conservative approach with lower fishing mortality reference points and higher biomass reference points than those that would be adopted under a single species management approach. Keeping the exploitation rate at or below the base of 15% for the Healthy Zone of the PA framework is thought to be conservative and leaves forage in the water for predators.

The PA reference points should be viewed with caution and need to be re-evaluated. Reference points were based the former shrimp fishing areas (SFA2 and SFA3) which are different than the current assessment zones so the biomass levels used to define the reference points may no longer be appropriate. In addition, the survey time series that were used to determine the reference points are much shorter than in other SFAs. For the EAZ, the time series included two years of data now not considered comparable with the rest of the series. The status of shrimp within the Western Assessment should no longer be represented by the current reference points established in 2013 (DFO 2013) because the reference points were based on survey results that are not comparable to the new time series begun in 2014. New reference points in the WAZ cannot yet be established. Some consideration, both by Science and Resource Management, should be given to the length of time series required to set appropriate reference points and when reference points should be revaluated.

SOURCES OF INFORMATION

This Science Advisory Report is from the 2015 Assessment of Northern and Striped Shrimp held February 17-23, 2015. Additional publications from this meeting will be posted on the DFO Science Advisory Schedule as they become available.

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Aussi disponible en français :

MPO. 2015. Évaluation des stocks de crevette nordique, Pandalus borealis, *et de crevette ésope,* Pandalus montagui, *en 2015 dans les zones d'évaluation est et ouest. Secr. can. de consult. sci. du MPO, Avis sci. 2015/017.*